Journal of Cystic Fibrosis 11 (2012) 456–457

Journal of Cystic Fibrosis

www.elsevier.com/locate/jcf

Short Communication

Prevalence of cystic fibrosis pathogens in the oropharynx of healthy children and implications for cystic fibrosis care☆

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Received 8 February 2012; received in revised form 5 April 2012; accepted 5 April 2012
Available online 30 April 2012

Abstract

Objective: To describe the prevalence of the CF pathogens *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Haemophilus influenzae* in OP cultures from healthy children.
Methods: Oropharyngeal (OP) swabs were collected from 100 healthy children ≤18 years of age undergoing a clinically indicated procedure.
Results: P. aeruginosa was isolated from the OP swab of one participant, *S. aureus* from 48 participants (including 4 methicillin-resistant) and *H. influenzae* from 47 participants. Cultures from 75 participants grew one or more of these organisms (55 grew one, 19 grew 2 and one grew 3 organisms).
Conclusion: P. aeruginosa is rarely recovered from the oropharynx of healthy children ≤18 years of age, while recovery of *S. aureus* and *H. influenzae* is common. It is important to understand what the "normal" prevalence of CF pathogens is in the oropharynx in order to aid interpretation of OP cultures in CF patients.

1. Introduction

The U.S. Cystic Fibrosis Foundation recommends obtaining respiratory cultures from CF patients at least quarterly to monitor for respiratory pathogens. In patients in the U.S. who cannot expectorate, these cultures are generally obtained from oropharyngeal (OP) swabs. While one prior study reported OP flora in healthy infants [1], to our knowledge there has been no prior systematic evaluation of OP flora from a broader age range of healthy children. Understanding the prevalence of CF pathogens in the oropharynx of healthy children would aid in the interpretation of culture results from CF patients. Our objective was to describe the prevalence of the CF pathogens *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Haemophilus influenzae* in OP cultures from children without known risk factors for *Pseudomonas* infection such as immunosuppression, recent antibiotic exposure, or indwelling catheters or devices.

2. Methods

We enrolled 100 children ≤18 years of age undergoing a clinically indicated procedure that required sedation or anesthesia at Seattle Children's Hospital, Seattle, WA, USA between September 2008 and February 2010. Exclusion criteria included: (1) Presence of indwelling catheters or devices (including myringotomy tubes) at enrollment or within the past year; (2) oral or IV antibiotic treatment within the past month; (3) presence of congenital or acquired immunosuppression; (4) history of cancer; (5) currently undergoing an otolaryngology or dental procedure; (6) immediate family member has CF; and (7) blood transfusion within the past year. An OP swab was collected from each participant and sent on the day of collection

☆ Prior presentation: Rosenfeld, M, Bernardo-Ocampo C, Emerson J, Khan U, Lymp J, Genatossio A, McNamara S, Barbieri J, Ramsey B, Gibson R. Upper airway microbiology and pseudomonas serology in healthy children. Pediatr Pulmonol 2011:309 Suppl. 34.

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doi:10.1016/j.jcf.2012.04.004

to the Therapeutics Development Network Center for CF Microbiology (at the same institution) for culture. Specimens were directly plated on blood, MacConkey, mannitol salt and Haemophilus selective agars, the latter three media for *P. aeruginosa*, *S. aureus*, and *H. influenzae*, respectively. Organisms were identified according to standard biochemical methods and methicillin resistant *S. aureus* was determined by oxacillin disc. The study was approved by the Seattle Children's Hospital IRB and informed consent was obtained from all parents/guardians, as well as assent from participants as applicable.

3. Results

Participants had a mean (SD) age of 8.6 (5.5) years, range 0.2 to 18 years; 41 were female and 59 male. OP cultures were obtained from 99 participants. *P. aeruginosa* was isolated from the OP swab of one participant, *S. aureus* from 48 participants (including 4 methicillin-resistant) and *H. influenzae* from 47 participants. Cultures from 75 participants grew one or more of these organisms (55 grew one, 19 grew 2 and one grew 3 organisms).

4. Discussion

Our results indicate that *P. aeruginosa* is rarely recovered from the oropharynx of healthy children $\leq$18 years of age (prevalence 1%), while recovery of *S. aureus* (48%) and *H. influenzae* (47%) is common. In 83 healthy infants <1 year of age, Carlson, et al. cultured *P. aeruginosa* from 4%, *S. aureus* from 27% and *H. influenzae* from 11% [1], suggesting that *P. aeruginosa* is also rarely isolated from the oropharynx of healthy infants. The slightly higher prevalence of *P. aeruginosa* in that infant cohort may reflect greater fecal–oral transmission of *P. aeruginosa* in infants [2].

In CF patients, OP cultures have limited sensitivity though reasonable specificity for the detection of *P. aeruginosa* and *S. aureus* in the lower airway [3]. Thus, it is important to understand what the "normal" prevalence of CF pathogens is in the oropharynx in order to aid interpretation of OP cultures in CF patients. Our results suggest that isolation of *P. aeruginosa* from an OP culture in a CF patient likely reflects the CF disease process and should be treated accordingly. *S. aureus*, while a known CF pathogen, is commonly isolated from the oropharynx of otherwise healthy children, complicating the interpretation of a positive OP culture in CF patients. In CF patients with an initial or chronically positive OP culture and new respiratory signs or symptoms, treatment with anti-staphyloccocal antibiotics is considered standard of care. Indeed, in many countries, anti-staphyloccocal prophylaxis is standard of care in the first two years of life [4]. Given the high prevalence of *S. aureus* in the oropharynx of healthy children, obtaining a lower airway sample should be considered in a CF patient with an initial positive OP culture in whom such information would change treatment. The role of *H. influenzae* as a pathogen in CF is less clear than that of *S. aureus*. Nonetheless, similar to *S. aureus*, in CF patients with a positive OP culture and new respiratory signs or symptoms, treatment with antibiotics directed against *H. influenzae* is considered standard of care. It should also be noted that, in contrast to the participants in the current study who by design had not been recently exposed to antibiotics, CF patients are frequently treated with antibiotics directed against organisms isolated from respiratory cultures. A positive culture from a recently treated CF patient may represent a treatment failure and a change in antibiotics may be warranted.

In our study, specimens were obtained from children undergoing sedation/anesthesia. While our eligibility criteria aimed to exclude children with chronic medical conditions, particularly those that might increase the risk of *P. aeruginosa* infection, study participants by definition had conditions requiring a procedure. In addition, the more vigorous oropharyngeal swabbing that can be performed under sedation may have increased the culture yield. Both of these factors would have the effect of increasing the apparent prevalence of oropharyngeal pathogens. The true prevalence of *P. aeruginosa* in the oropharynx of healthy children in the community may be even lower than our observed rate of 1%. Thus, isolation of *P. aeruginosa* from an OP culture in a CF patient likely reflects the CF disease process.

References

[1] Carlson D, McKeen E, Mitchell M, Torres B, Parad R, Comeau AM, et al. Oropharyngeal flora in healthy infants. Pediatr Pulmonol 2009;44:497–502.
[2] Rotimi VO, Duerden BI. The development of the bacterial flora in normal neonates. J Med Microbiol 1982;14:51–62.
[3] Rosenfeld M, Emerson J, Accurso F, Armstrong D, Castile R, Grimwood K, et al. Diagnostic accuracy of oropharyngeal cultures in infants and young children with cystic fibrosis. Pediatr Pulmonol 1999;28:321–8.
[4] Littlewood J, Bevan A, Connett G, Conway S, Dodd M, Govan J, et al. Antibiotic treatment for cystic fibrosis. Cystic Fibrosis Trust Website; 2002. Available at: http://www.cftrust.org.uk/aboutcf/publications/consensusdoc/C_3200Antibiotic_Treatment.pdf.